



THURBER ENGINEERING LTD.

MEMORANDUM

To: Jonathan Borch, P.Eng.
Urban Systems Ltd.

Date: May 27, 2021

From: Denny Ma, P.Eng.
(Reviewed by J. Suzanne Powell, Ph.D., P.Eng.)

File: 27895

HIGHWAY 99 BUS ON SHOULDER LANE SURVEY REQUIREMENTS FOR PRELOAD

As requested, this memorandum summarizes the survey requirements for the Highway 99 Bus on Shoulder Project between the George Massey Tunnel and Matthews Interchange in Delta, BC. This memo must be read in conjunction with our geotechnical report for the same project dated October 30, 2020.

It is a condition of this memo that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

We understand that the Ministry Representative will arrange for survey and monitoring of all preload settlement gauges and settlement hubs. The proposed spacing for the settlement hubs and settlement gauges are noted on the design drawings R1-970-102 to 108 and R1-970-801 to 806.

Preload survey requirements are listed below.

- We suggest the surveyor should have a minimum of 5 years surveying experience preferably related to preload settlement monitoring. The Ministry Representative shall determine the appropriate surveyor and qualification to complete the preload survey for the duration of the project.
- The surveyor will be responsible for survey of the settlement gauges and settlement hubs and the top of fill immediately adjacent to the gauges and hubs. For settlement gauges, the surveyor must also note the length of the extensions when added and any damage or other issues that could be relevant to interpretation of settlement monitoring data.
- At the onset of the work, the surveyor should establish three stable, independent benchmarks. The absolute elevation of the benchmarks shall be confirmed at least three times during the course of preloading, including once prior to commencement of preload fill placement, once during and once near completion of preloading.
- All survey readings will be referenced to three independent benchmarks for each round of survey. All survey circuits shall be closed and the surveyor shall check the readings on site to confirm that they are reasonable prior to forwarding the result to the Ministry



Representative. The Ministry Representative will forward the data to Thurber for review and assessment.

- The surveyor shall use methods and equipment that will achieve a reading accuracy of ± 2 mm or better.
- The required monitoring frequency for the settlement gauges is outlined below.
 - Baseline readings comprising at least three readings over a three-day period showing negligible movement within ± 2 mm, or as agreed in writing by the Ministry Representative.
 - 1 reading upon installation.
 - 2 readings per week during fill placement.
 - 1 reading per week for the first month after completion of fill placement.
 - 1 reading every 2 weeks for the remainder of the preload duration.
- The required monitoring frequency for the settlement hubs is outlined below.
 - 1 reading immediately after fill placement.
 - 1 reading per week for the first month.
 - 1 reading every 2 weeks for the remainder of the preload duration.
- The survey data should be submitted electronically (Microsoft Excel or similar) to the Ministry Representative within 24 hours after being collected. The Ministry Representative should confirm specific formatting requirements for monitoring review and data processing. We suggest the following format to facilitate data processing.

Gauge ID or station	Date	Base of Plate Elevation	Elevation		Length of Extension / Riser added	Comments
			Top of Fill	Top of Gauge		

We trust that this information is sufficient for your needs. Should you require clarification of any item or additional information, please contact us at your convenience.

Attachment Statement of Limitations and Conditions



MAY 27, 2021



STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.